Calibration and Validation of SMOS-derived Soil Moisture Data in the Central Part of the Duero Basin: Experimental Activities

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Summary

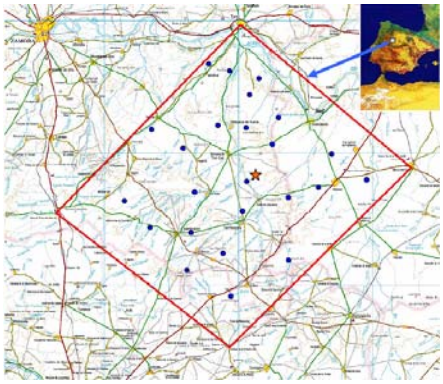
This poster presents a field experiment to be carried out at the **REMEDHUS site**, Zamora-Salamanca Region, Spain, from October 2008 to September 2009.

The main **objectives of this experiment** are:

1. Validate and calibrate SMOS-derived soil moisture
2. Study the variability of soil moisture within the SMOS footprint
3. Test pixel disaggregation techniques to improve the spatial resolution of SMOS observations
4. Determine the optical depth and vegetation water content and assess their influence on brightness temperature and on soil moisture estimates
5. Characterize the roughness factor

1. THE EXPERIMENT SITE

- REMEDHUS site in Zamora-Salamanca Region, Spain (41.1° to 41.5° N and 5.1 ° to 5.7° W), area = 1300 km^2
- Continental and semi-arid climate: cold winters and warm summers (12°C annual mean temperature and 400 mm rainfall)
- Land uses: farmland (cereals and vineyards) with small areas of bare soil and pine forest (pinus pinea)



- REMEDHUS site perimeter is indicated with a red rectangle
- Blue dots: soil moisture sensor networks (x23)
- Red star: position of the LAURA radiometer (41.18°N, 5.22°W, 716m altitude)

2. GROUND-TRUTH MEASUREMENTS

- Soil moisture
  - Sensors installed nearby LAURA radiometer: 10 Hydra Probes to simultaneously obtain soil moisture, soil temperature and dielectric constant values: at the soil surface (x5) , and at depths of 5, 10, 15, 25, and 50 cm
  - Sensors at each of the 23 REMEDHUS soil moisture stations: Tektronix 1502C, TDR (x4) at 5, 25, 50 and 100 cm, and Hydraprobe (x1) at 5 cm
- Temperature
  - IR thermometer (x1) and thermometer for measuring the vegetation temperature (x1)
- Roughness
  - GS200 3D Laser Scanner
  - Close-range photogrammetry device: 60x60 cm^2 wooden frame with reference marks
- Vegetation
  - Biomass, VWC, LAI, NDVI
- Meteorological measurements
  - Relative air humidity, air temperature, wind speed and wind speed direction, global radiation, and precipitation


GS200 3D Laser Scanner


Photogrammetry device


Meteo station

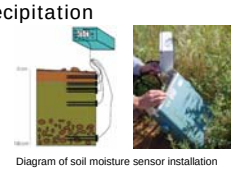


Diagram of soil moisture sensor installation

Acknowledgements

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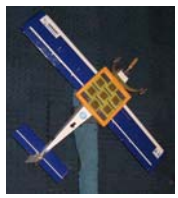
3. L-BAND PASSIVE MICROWAVE MEASUREMENTS

- Continuous microwave L-band measurements at various incidence angles will be acquired over a cereal field using the ground-based L-band AUtomatic RAdiometer (**LAURA**)

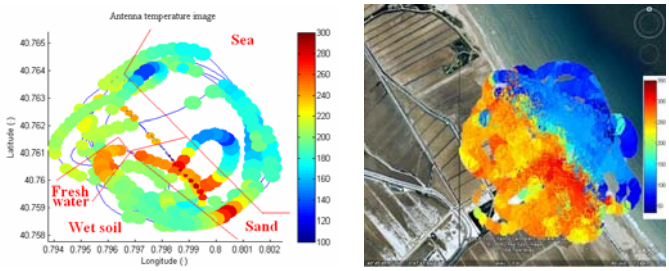
- From left to right, LAURA during the TuRTLE 2006, T-REX 2006 and SMOS REFLEX 2006 experiments

- Flights at different heights will be performed at the REMEDHUS site using the Airborne RadIomEter at L-band (**ARIEL**) to analyze brightness temperatures images at different spatial resolutions


Antenna pattern measurements at the UPC anechoic chamber


ARIEL during a test flight


View of the UAV, radio-controled, 2.5m wingspan, up to 5 kg load



Antenna temperature image (in K) acquired by ARIEL during a test-flight at the Ebro river mouth, Spain. Images can be represented in lat/long coordinates or geo-referenced on Google-Earth

4. HIGH RESOLUTION TB SIMULATOR AND LEVEL-2 SOIL MOISTURE RETRIEVAL

- High resolution TB images using in-situ auxiliary data will be simulated with the SMOS End-to-end Performance Simulator (SEPS) and then aggregated to be compared to SMOS TB data
- A Level 2 Soil Moisture processor has been developed so that SMOS-derived and in-situ soil moisture could be compared in near real time

Conclusions

- A Calibration/Validation strategy for SMOS-derived soil moisture data has been developed
- Specific experiments have been planned to study the soil moisture variability within the SMOS footprint and to explore the possibility of enhancing the spatial resolution of future SMOS data